MAVEN

Mars Atmosphere and Volatile Evolution Mission

CU/LASP • GSFC • UCB/SSL • LM • JPL

FACT SHEET

"Definitive Answers about Mars Climate History"

Science Objectives

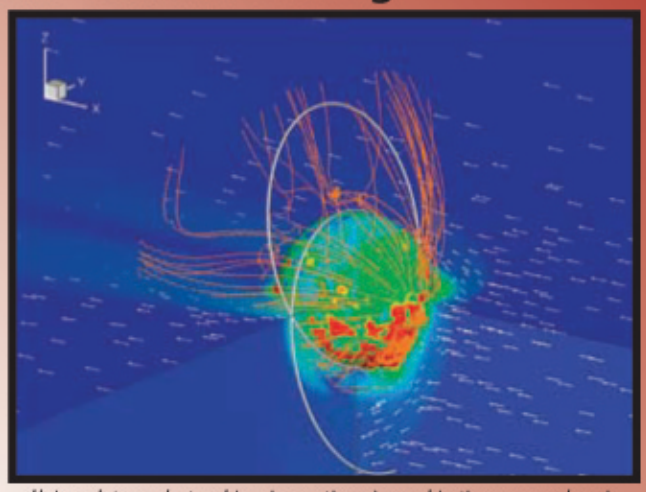
- Determine the role that loss of volatiles from the Mars atmosphere to space has played through time, allowing us to understand the histories of Mars' atmosphere and climate, liquid water, and planetary habitability
- Determine the current state of the upper atmosphere, ionosphere, and interactions with the solar wind
- Determine the current rates of escape of neutrals and ions to space and the processes controlling them
- Determine the ratios of stable isotopes that will tell us the history of loss through time

Importance to Mars Exploration Program

- Comprehensively addresses key science objectives for upper atmosphere, solar-wind interaction, and escape to space, as defined by MEPAG (2006) and the NRC (2003)

Why MAVEN?

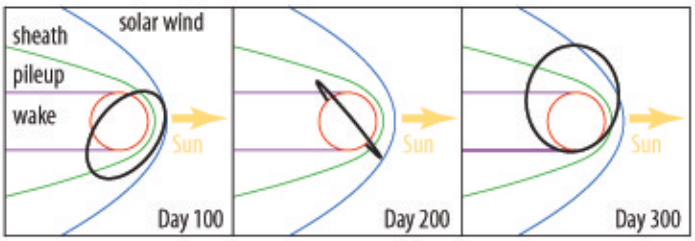
- Unparalleled Mars upper-atmosphere science products and results
- A high-fidelity mission cost based on prior Mars missions
- The highest level of mission success based on Mars-proven spacecraft hardware and processes and flight-proven instruments



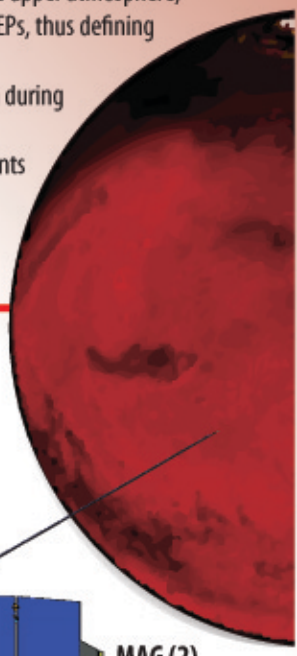
Unique data products achieve innovative science objectives, as seen here in a MAVEN team simulation of solar-wind impingement and ion escape.

Mission Overview

- Leave Earth on an EELV between November 18 and December 7, 2013
- Mars Orbit Insertion (MOI) on September 16, 2014 (for 11/18 launch)
- 75° inclination, 4.5 hour period, 150 km periapsis altitude science orbit
- Over a 1-year period, obtain detailed measurements of the upper atmosphere, ionosphere, planetary corona, solar wind, solar EUV and SEPs, thus defining the interactions between the Sun and Mars
- Perform 5 "Deep Dip Campaigns" to altitudes near 125 km during the 1-year mission. Each campaign is 5 days in duration and captures previously unobtainable science measurements



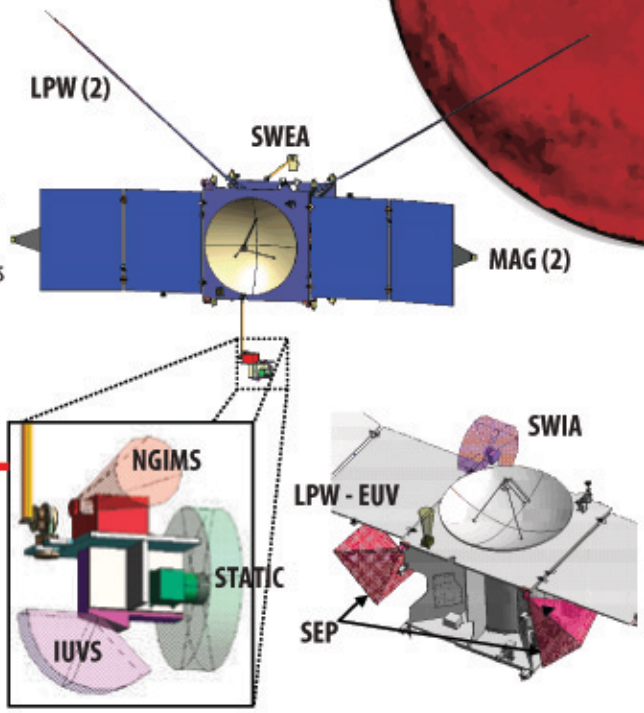
MAVEN's orbit (black line) supports measurements over most latitudes and local times.



Comprehensive Science Payload With Extensive Flight Experience

- **Particles and Fields (P&F) Package:**
  - Solar Wind Electron Analyzer (SWEA) – Measures solar wind, and ionospheric electrons
  - Solar Wind Ion Analyzer (SWIA) – Measures solar wind and magnetosheath ion density and velocity
  - Suprathermal and Thermal Ion Composition (STATIC) – Measures thermal ions to moderate-energy escaping ions
  - Solar Energetic Particle (SEP) – Determines the impact of SEPs on the upper atmosphere
  - Langmuir Probe and Waves (LPW) – Determines ionospheric properties and wave heating of escaping ions, and solar EUV input to atmosphere
  - Magnetometer (MAG) – Measures interplanetary, solar wind, and ionospheric magnetic fields
- **Remote Sensing (RS) Package:**
  - Imaging Ultraviolet Spectrometer (IUVS) - Measures global characteristics of the upper atmosphere and ionosphere
- **Neutral Gas and Ion Mass Spectrometer (NGIMS):**
  - Measures the composition and isotopes of thermal neutrals and ions

All Instrument FOVs are Fully Accommodated



MAVEN Mission Management

Principal Investigator • Dr. Bruce M. Jakosky • LASP, University of Colorado
Deputy Principal Investigator • Dr. Robert P. Lin • SSL, University of California at Berkeley
Project Scientist • Dr. Joseph M. Grebowsky • NASA's Goddard Space Flight Center
Project Manager • Mr. David F. Mitchell • NASA's Goddard Space Flight Center
Deputy Project Manager • Mr. Donald E. Carson • NASA's Goddard Space Flight Center
Flight Systems Manager • Mr. Edward J. Sedivy • Lockheed Martin

The MAVEN Team

- University of Colorado/Laboratory for Atmospheric and Space Physics (LASP) coordinates the science team, science operations, E/PO, management for RS package, and provides the IUVS, LPW and RSDPU
- NASA's Goddard Space Flight Center (GSFC) provides project management, mission systems engineering, safety and mission assurance, project scientist, MAG and NGIMS
- University of California, Berkeley/Space Science Laboratory (SSL) provides management for the P&F Package, and provides the STATIC, SEP, SWIA, SWEA instruments, the probes and booms for LPW and the PFDPU
- Centre d'Etude Spatiale des Rayonnements (CESR) provides the sensor for SWEA
- Lockheed Martin (LM) develops the spacecraft, conducts assembly, test and launch operations (ATLO), and provides mission operations
- Jet Propulsion Laboratory (JPL) performs navigation duties - trajectory and orbit maintenance analysis

The MAVEN Science Team

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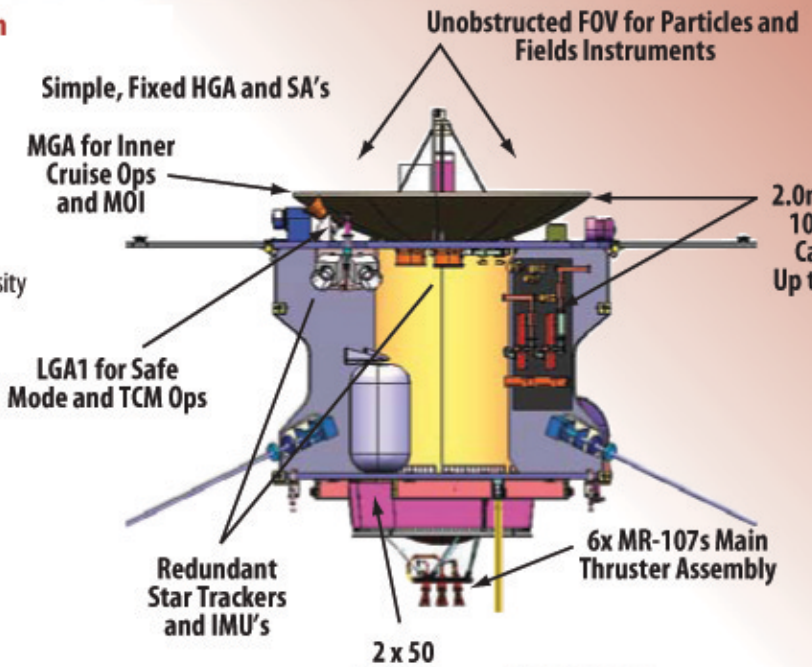

Flight Systems Characteristics

- Fully compatible with Delta IV and Atlas V EELVs
- Derivative of MRO spacecraft structure
- Flight proven avionics suite (MRO)
- All subsystems block or functionally redundant with cross strapping
- Single fault tolerant monoprop system
- 1231W EOL supply from solar arrays (UTJ cells)
- Two NiH_2 batteries at 50 Ahr each
- X-band communication
- 2.0m dia HGA, 100W TWTAs
- Reaction wheels/IMUs/star trackers capable of operating during upper atmosphere passes
- 99% Delta-V = 2029 m/s

Ground Data System

- 34m DSN
- LM Class 1 Mission Support Area (MSA)
- LASP Science Operations Center
- 24/7 coverage during major spacecraft events
- Only 10 hours of DSN downlink per week required during Mars mapping
- No relay support required from the Mars infrastructure

Key Margins

- Mass Margin: 11.9% contingency + 29.2% dry mass margin
- Power Margin: 14.3% contingency + 35.8% system margin
- Max battery DOD: 35.6%
- Data throughput margin: 159.3% against MEV
- Mass Memory Margin: 753% against MEV

Education and Public Outreach

- Active utilization of social media (YouTube, Facebook, MySpace, blogs, etc.)
- Project SPECTRA! at LASP will develop a series of MAVEN-science-related Solar System Exploration Stories
- The Science Education Gateway (SEGway) at SSL will create a Mars space weather web site
- The SETI Institute will develop an adult Girl Scout Leader training class and activities/materials "Girls Go to Mars" Kit
- Science journalist workshop to reach widest possible audience

Schedule